

**Document IWG 4-7(Rev.1)**

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**[Draft] Proposals for the Work of the Conference  
APFD( $\text{EPFD}_{\text{up}}$ ) Limits**

Proposals for Agenda Item 1.13.1 to review and, if appropriate, revise the power limits appearing in Articles S21 and S22 in relation to the sharing conditions among Non-GSO FSS, GSO FSS, GSO BSS, space services and terrestrial services to ensure the feasibility of the power limits and that these limits do not impose undue constraints on the development of these systems and services.

**Background**

WRC-97 incorporated into Article S22 provisional limits and a definition of an aggregate pfd (APFD) to protect GSO FSS co-frequency satellite systems from Non-GSO FSS Earth-to-space transmissions systems. The ITU-R JTG 4-9-11 was established to examine these limits. The Long Beach, California meeting of the JTG agreed to modify the definition of Aggregate PFD (APFD) to Equivalent PFD ( $\text{EPFD}_{\text{up}}$ ) by the addition of the GSO FSS spacecraft antenna directivity to the definition. This resulted in modification of APFD limits to  $\text{EPFD}_{\text{up}}$  limits.

## Proposals Under Agenda Item 1.13.1

USA/1.13.1/A

MOD

Table S22-4

Table S22-4

## Part A

Frequency Band (GHz)	<del>apfd</del> (epfd) <sub>up</sub> dB(W/m <sup>2</sup> )	Percentage of time during which <del>aggregate</del> <u>equivalent</u> Level may not be exceeded	Preference bandwidth (kHz)	<u>Reference antenna beamwidth and reference Radiation pattern</u>
12.55-12.75 12.75-13.25 13.75-14.5	<del>-170</del> <del>-186</del> -170 <del>-170</del>	100	4	4 degrees ITU-R S.672, Ls = -20

## Part B

Frequency Band	<del>apfd</del> (epfd) <sub>up</sub> dB(W/m <sup>2</sup> )	Percentage of time During which <del>aggregate</del> <u>equivalent</u> level may not be Exceeded	Reference bandwidth (kHz)	<u>Reference antenna Beamwidth and reference Radiation pattern</u>
27.5-28.6	<del>-148</del> <del>-159</del>	100	1000 <del>-40</del>	1.55 deg., ITU-R S.672, Ls = -10
29.5-30.0	<del>-148</del> <del>-145</del>	100	1000	1.55 deg., ITU-R S.672, Ls = -10

USA/1.13.1/B

MOD

S22.5F

The equivalent ~~aggregate~~ power flux density  $up^2$  produced at any point in the geostationary-satellite orbit by emissions from all visible ~~the~~ earth stations in a non geostationary-satellite system in the fixed satellite service, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-4 for any percentage of time. These limits relate to the power flux-density which would be obtained under free space propagation conditions in the referenced bandwidth specified in Table S22-4.

USA/1.13.1/C

$${}^2 EPFD_{up} = 10 \log \left( \sum_{i=1}^{N_e} 10^{P_i/10} * \frac{G_t(\theta_i)}{4\pi d_i^2} * \left[ \frac{G_r(\phi_i)}{G_{r,max}} \right] \right)$$

MOD

S22.5F.1

Where:

$\left[ \frac{G_r(\phi_i)}{G_{r,max}} \right]$  is the normalized gain characteristic of the GSO receiving beam, and

- $EPFD_{up}$  is the aggregate equivalent power flux-density in dB(W/m<sup>2</sup>) in the reference bandwidth;
- $N_e$  is the number of earth stations in the non-geostationary-satellite system with an elevation angle greater than or equal to 0°, from which the point considered in the geostationary-satellite orbit is visible;
- $i$  is the index of the earth station considered in the non-geostationary-satellite system;
- $P_i$  is the RF power at the input of the transmitting antenna of the earth station considered in the non-geostationary-satellite system in dBW in the reference bandwidth;
- $\theta_i$  is the off-axis angle between the boresight of the earth station considered in the non-geostationary satellite system and the direction of the point considered in the geostationary-satellite orbit;
- $G_t(\theta_i)$  is the transmit antenna gain (as a ratio) of the earth station considered in the non-geostationary-satellite in the direction of the point considered in the geostationary-satellite orbit;
- $d_i$  is the distance in metres between the earth station considered in the non-geostationary-satellite system and the point considered in the geostationary-satellite orbit;
- $\phi_i$  is the angle at which the non-GSO earth station is seen with respect to the pointing direction of the GSO receive satellite antenna direction;
- $G_r(\phi_i)$  is the receive antenna gain of the geostationary satellite as a function of the angle  $\phi_i$ ;
- $G_{r,max}$  is the maximum gain of the geostationary receive antenna of the satellite.
- ~~$apfd$  is the aggregate power flux density in dB (W/m<sup>2</sup>) in the reference bandwidth~~

Reason:

To more accurately define the interference level from co-frequency NGSO FSS systems into receive GSO satellite antennas by taking into account the GSO satellite antenna directivity. And to define acceptable  $\text{epfd}_{\text{up}}$  values for the 12.55-12.75 GHz, 12.75-13.25 GHz, 113.75-14.5 GHz, 27.5-28.6 GHz and 29.5-30.0 GHz.